

REMARKS

Applicant gratefully acknowledges the Examiner's indication that claim 53 is allowed. Applicant requests reconsideration of this application in view of the following remarks and accompanying amendments. Claims 1-58, 82-86, and 90-100 were pending. Applicant amends claims 54-58, 82, and 85 herein. As a result, claims 1-58, 82-86, and 90-100 remain pending in the instant application.

Claims 47-51 stand rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement. Applicant traverses this rejection for at least the following reasons.

Regarding claims 47 and 48, the Office Action recites that "there isn't sufficient enablement nor illustration of the third set of displacing, dispersing, splitting means to allow one to make the apparatus claimed. Further, the only mention of in the specification of this is in the summary which is a copy of the claims." Applicant respectfully disagrees with this position because the third set of displacing, dispersing, and splitting means are implicitly disclosed in the specification and figures. For example, FIG. 9 shows displaced beams 41 and 42 provided to beam splitter 99. In other words, FIG. 9 shows three gaps, g due to displacing means not shown, and g' and g'' due to displacing means 59 and 59' respectively. The third displacing means is the displacing means which provides beams 41 and 42 in the first place. For at least the reason that the third displacing means is inherently disclosed, Applicant respectfully requests reconsideration and withdrawal of this rejection of claims 47 and 48 under 35 U.S.C. § 112, second paragraph.

Regarding claims 49-51, the Office Action recites that "the optical duplicating element is not enabled in the specification nor shown in the figures and the examiner cannot find in the specification where it is enabled except again in the summary which is a copy of the claims and inadequate to fully enable the limitation." Applicant respectfully disagrees with this position as well for at least the reason that one of ordinary skill in the art would be enabled to use any of many optical duplicating elements described in Applicant's specification to implement the claimed invention. For example, FIG. 1 discloses a Michelson interferometer (i.e., a duplicating element) to generate Talbot bands. As an alternative example, in FIG. 2 the duplicating element

is the plate which splits the beam into two beams, one delayed. In addition, Applicant's specification refers extensively to duplicating elements, for example ¶ [0211] refers to a differential delay, ¶¶ [0212] and [0213] explain how a duplicating element, which introduces a differential delay, is to be used, and ¶ [0214] describes how a replica is to be created. As further examples, in ¶ [0215] the duplicating element is a glass plate, in ¶ [0216] the duplicating element is the cavity of a laser diode, and in ¶ [0217] the duplicating element is the cavity of a superluminescent diode. One of ordinary skill in the art understands that a duplicating element is one which introduces a differential delay or creates a delayed replica. For at least the reason that Applicant's specification and figures fully disclose and enable one of skill in the art to make and use the claimed invention, Applicant respectfully requests reconsideration and removal of the rejection of claims 49-51 under 35 U.S.C. § 112, first paragraph.

Claims 54-58, 82-86, and 90-92 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Applicant amends these claims in to clarify the steps involved in the method/process and to recite active, positive steps delimiting how the use is actually practiced. These amendments add no new matter. In view of these amendments, Applicant respectfully requests reconsideration and withdrawal of this rejection under 35 U.S.C. § 112, second paragraph.

Claims 54-58, 82-86, and 90-92 stand rejected under 35 U.S.C. § 101 because the claimed recitation of a use, without setting forth any steps involved in the process, results in an improper definition of a process. Applicant amends these claims in to clarify the steps involved in the method/process and to recite active, positive steps delimiting how the use is actually practiced. These amendments add no new matter. In view of these amendments, Applicant respectfully requests reconsideration and withdrawal of this rejection under 35 U.S.C. § 101.

Claim Rejections – Prior Art

Claims 1-7, 9, 12, 13, 16, 18-25, 29, 31, 32, 36, 37-39, and 94-100 stand rejected under 35 U.S.C. § 102(e) as anticipated by de Boer et al. (U.S. Pub. No. 2005/0018201 A1). Claims 11, 14, 26-28, 30, 33, 40-46, 52, and 93 stand rejected under 35 U.S.C. § 103(a) as unpatentable over de Boer. Claim 15 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over de

Boer in view of Applicant's admitted prior art. Applicant traverses these rejections for at least the reason set forth below.

Applicant's previous response, filed July 21, 2009, amended the independent claims to recite that the optical spectrum dispersing means receives the relatively displaced object beam and the relatively displaced reference beam on different portions of the optical spectrum dispersing means *due to lateral displacement* of the two relatively displaced beams caused by the displacing means. In response to this amendment and its accompanying remarks, the present Office Action indicates that claim 53 is allowed. The Examiner's statement of reasons for allowance clarifies that,

the prior art of record, taken alone or in combination, fails to disclose or render obvious *displacing the reference and object beams laterally and projecting them onto different portions of the optical spectrum dispersing means*, in combination with the rest of the limitations of the claim

(Office Action, p. 13, emphasis added). However, all other independent claims remain rejected even though they recite analogous features not disclosed or rendered obvious in the prior art of record. For example, claim 1 recites the feature,

optical spectrum dispersing means arranged to receive *the relatively displaced object beam and the relatively displaced reference beam on different portions of the optical spectrum dispersing means due to lateral displacement of the two relatively displaced beams caused by the displacing means*, and arranged to disperse the spectral content of the two displaced beams onto a reading element such that the dispersed relatively displaced reference beam and the dispersed relatively displaced object beam are superposed on the reading element

(emphasis added). Claims 4 and 6 each recite features analogous to this feature of claim 1. As alternative example, claim 54 recites the feature,

arranging optical spectrum dispersing means to receive *the relatively displaced object beam and the relatively displaced reference beam on different portions of the optical spectrum dispersing means due to lateral displacement of the two relatively displaced beams caused by the displacing means*, and to disperse the spectral content of the two displaced beams onto a reading element such that the dispersed relatively displaced reference beam and the dispersed relatively displaced object beam are superposed on the reading element;

(emphasis added). Claims 55 and 57 recite features analogous to this feature of claim 54. Claims 93-95 and 98 additionally recite similar features. For at least the reasons presented in Applicant's July 21, 2009 response, and for the reason that the Examiner conceded that these recited features are not rendered obvious in view of the prior art of record, Applicant respectfully requests reconsideration and removal of the prior art rejections of independent claims 1, 4, 6, 54, 55, 57, 93-95, and 98.

As separate and independent grounds for patentability, Applicant's previous response additionally amended the independent claims to recite that the optical spectrum dispersing means disperses the spectral content of the beams onto a reading element *such that the relatively displaced reference beam and the relatively displaced object beam are superposed on the reading element*. Applicant contends that de Boer is a type of apparatus similar to the conventional arrangements discussed in the opening portions of this patent application, and thus differs considerably from that of the invention as recited in independent claims 1, 4, 6, 54, 55, 57, 93-95 and 98.

De Boer teaches a beam from a source 202 is split by a splitter 204 into a beam for a reference arm 206 and a beam from a sample (i.e. object) arm 208 (*e.g.*, de Boer, paragraph [0081] and FIG. 3). The beams from the reference arm 206 the sample arm 208 are recombined by the splitter 204 and provided to a grating 212 (*e.g.*, de Boer, paragraph [0081] and FIG. 3). The grating 212 disperses the spectral content of the beams from the reference arm 206 the sample arm 208 onto a detector array 216 (*e.g.*, de Boer, paragraph [0081] and FIG. 3). The beams from the reference arm 206 the sample arm 208 in de Boer are thus superposed on the grating 212, which then disperses the superposed beams onto the detector array 216 (*e.g.*, de Boer, paragraph [0081] and FIG. 3).

As defined in the present independent claims, the "optical spectrum dispersing means" (which could, for example, be a grating) receives the beam from the reference arm and the beam from the object arm (the two "relatively displaced beams" in the present independent claims) on different portions of the optical spectrum dispersing means due to lateral displacement of the two relatively displaced beams caused by the displacing means (*see*, the arrows throughout Applicant's figures illustrating what the displacing means do). The "optical spectrum dispersing

means” disperses these two laterally displaced beams so that they are superposed onto the reading element.

However, in de Boer there is **no such lateral displacing of the two beams**. The Examiner argues that that the transition stage 270 in the reference arm of de Boer is the “displacing means” of claim 1 (*see*, Office Action, page 5). However, it is clear that the transition stage 270 is *not* functionally equivalent to the stage 63 in Figure 3 of the present invention. The transition stage 270 of de Boer *does not* laterally displace the beams such that the grating 212 receives the beams from the object and reference arms on different portions of grating 212. Splitter 204 combines the beams from the reference arm 206 and the object arm 208 such that they are superposed onto the grating 210 in the de Boer reference. Instead, in de Boer, the only displacement by stage 270 is in the axial direction in the reference arm (i.e. along the beam direction of the reference arm). This axial displacement in de Boer creates the optical path difference in the interferometer. Thus, Applicant submits that the transition stage 270 helps create the optical path difference in the interferometer of de Boer.

In contrast to de Boer, Applicant’s arrangement of the displacing means and the optical spectrum dispersing means creates *an intrinsic optical delay* between the wavetrains of the relatively displaced object beam and the relatively displaced reference beam which can be used with the optical path difference in the interferometer to generate a channelled spectrum for the optical path difference in the interferometer on the reading element.

The “intrinsic optical delay” recited in the independent claims results from the lateral displacement of the beams from the object and reference arms on different portions of the optical spectrum dispersing means. The combination of the “intrinsic optical delay” with the “optical path difference” (relating to the path difference from the reference arm and the object arm”) creates a channelled spectrum for the optical path difference.

Both Applicant’s invention and de Boer relate to two optical phenomena, interference and diffraction. The order of operation of Applicant’s invention, though, is totally different than that of de Boer. Applicant’s invention applies diffraction first and interference second, thereby allowing the system to alter the superposition of the displaced beams on the reading element.

This allows for an intrinsic delay. In contrast, de Boer discloses interference first and diffraction second, this is why the two beams are superposed in their way towards the dispersion means and this is why the intrinsic delay is always zero in de Boer while the optical path difference (ODP) may vary.

Further, the placement of stage 270 and the lens of de Boer prevent the elements from affecting the gap of the two beams. In de Boer, the two beams are always superposed, even before reaching the dispersing element. In de Boer, there is no way to separate the two beams, they come from the fiber coming out from the splitter superposed already. Thus, transition stage 270 cannot change the gap between the two beams at the other end. Indeed, de Boer has not contemplated any gap, the relation between the beam diameter and the gap in influencing the sensitivity curve with depth, how an intrinsic delay is created, how the intrinsic delay depends on the number of grating lines within the gap, the possibility to combine this intrinsic delay with the OPD to change the visibility versus OPD, or Talbot bands.

In summary, de Boer fails to teach or suggest an “intrinsic optical delay” (which is distinct from “optical path difference”) by lateral displacement of the beams from the reference and object arms. The system of de Boer merely permits adjustment of the length of the reference arm by means of a conventional transition stage 270. There is no allusion in de Boer to the problem of mirror terms (i.e., to the insensitivity to the OPD sign and the problem of decay of sensitivity with depth). These are major drawbacks of the conventional FD-OCT setups, such as that described in de Boer. Because there is no allusion to these problems, there is no motivation for de Boer to avoid or eliminate the mirror terms or alter the sensitivity with OPD of this method.

Instead, Applicant provides a solution to this problem unaddressed by de Boer. By modifying the gap, Applicant’s claimed invention attenuates up to elimination the mirror term and moves the max sensitivity inside the tissue. In other words, by creating a lateral gap, Applicant moves the max sensitivity, having a max in $OPD=0$, to regions inside the tissue due to intrinsic delay. The entire sensitivity curve moves sideways, and regions can have OPD where there is no sensitivity, including $OPD=0$. This leads to total elimination of the mirror terms and no sensitivity to the other sign of OPD.

In view of the foregoing, it is submitted that the present application is in condition for allowance and a notice to that effect is respectfully requested. If, however, the Examiner deems that any issue remains after considering this response, the Examiner is invited to contact the undersigned attorney to expedite the prosecution and engage in a joint effort to work out a mutually satisfactory solution.

Except for issue fees payable under 37 C.F.R. § 1.18, the Commissioner is hereby authorized by this paper to charge any additional fees during the entire pendency of this application including fees due under 37 C.F.R. §§ 1.16 and 1.17 which may be required, including any required extension of time fees, or credit any overpayment to Deposit Account No. 19-2380. This paragraph is intended to be a **CONSTRUCTIVE PETITION FOR EXTENSION OF TIME** in accordance with 37 C.F.R. § 1.136(a)(3).

Respectfully submitted,

NIXON PEABODY LLP

/Jeffrey L. Costellia, Reg. No. 35,483/
Jeffrey L. Costellia
Registration No. 35,483

NIXON PEABODY LLP
CUSTOMER NO.: 22204
Suite 900, 401 9th Street, N.W.
Washington, D.C. 20004-2128
(202) 585-8000